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CENTRAL INTELLIGENCE AGENCY

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COUNTRY East Germany

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The following are reports on the three so-called "D-Themes" which are being carried out by Department 3 of the Heinrich Hertz Institute for Oscillation Research in East Berlin. The reports describe progress made between 1 January and 30 June 1956.

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Theme: Research on the Propagation of UKW (very high frequency) in the Troposphere

Short Designation: Troposphere

1. Research included wave propagation in the meter range beyond the horizon. The basis for research was the theoretical work of Schachenmeier, which for the first time takes into consideration the influence of an inhomogeneous atmosphere on diffraction and refraction and thus provides the theoretical basis for the propagation mechanism up to shortly beyond the horizon. Experimental proof was to be found for the validity of the theoretical deductions.

2. Measured data obtained at 68 MHz (megacycles) on an experimental line 76 kilometers long with Radiosonden Station Lindenberg at the center were compared with calculated values; the required meteorological values were furnished by Radiosonden Station Lindenberg. Measured and calculated values were in fairly close agreement, with correlation coefficients of between 0.3 and 0.5. It was determined, however, that great deviations occurred on certain days, a fact which indicated that other factors influence wave propagation. After this had been determined, investigations were made

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to find out to what extent partial reflections on inversion layers can also contribute to reception field intensity. By taking these factors into consideration, correlation co-efficients were corrected to between 0.6 and 0.7. Thus, the relation worked out by Schachenmeier with consideration of reflection phenomena was experimentally proven and the wave propagation mechanism up to shortly beyond the horizon was clarified. The results were published in the January 1956 issue of Hochfrequenztechnik und Elektroakustik. Measurements continued to be made to obtain data on the average daily variations.

3. As soon as the construction of an experimental line with a wave-length of 10.5 centimeters is completed, the equipment is to be used for transmitting measuring directives. It is planned to repeat a measuring series at 68 MHz after completion of a new type of radiosonde which is to furnish more exact meteorological data on a continuing basis. A scheduled date for this repeat measurement series cannot be fixed as yet. In view of the results obtained, the research theme can be considered completed by the end of 1956. A termination report on the theme will be submitted before the end of 1956.

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Theme: Field Intensity Recordings in the Centimeter Wave Range

Short Designation: Field Intensity Centimeter Waves

1. In order to shed light on the mechanism of wave propagation over great distances, research is to be expanded to include the centimeter wave range. Especially, the distribution and magnitude of the individual components of the reception field intensity are to be investigated in respect to the evaluation and side * in order to obtain knowledge of the precise structure of the atmosphere and its effect on wave propagation. For this purpose the sharpest possible focussing by both transmitter and receiver is necessary. Such focussing requires research in the centimeter range. A wave-length of 10.5 centimeters was chosen. The experiments are to be carried out over the same 76-kilometer line with Radiosonden Station Lindenberg at its center. Large transmission power, such as is available in the United States (about 10 kw) for such experiments, is not available in East Germany; only a transmitter of about 7w will be available. Therefore, the receiving apparatus must be especially sensitive. The "lock-in" procedure, which makes it possible to measure the signal indicator even despite the noise of the receiving device, was chosen. With such a procedure the sensitivity can be increased over normal receivers by the factor 10^3; however, the procedure requires a rather complicated apparatus.

2. The apparatus is now under construction, and it is estimated that measurements can begin by the fall of 1956. Four-meter parabola mirrors are used as antennae; at a wave-length of 10.5 centimeters they have a focussing width of 1.5 degrees, and they can be microtuned for evaluation and side *.

* Note: Höhe und Seite.

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Theme: Field Intensity Recordings of Fixed Stations in the Ultrashort Wave Range

Short Designation: Field Intensity Ultrashort Wave

1. After it became possible to work with higher transmitting power and antennae, it was determined that reception field intensities occurred at great distances and over a wide frequency band up to several thousand MHz. These intensities deviated considerably from those to be expected on the basis of the diffraction theory. For great distances, the observed values exceeded those of the classical theory by several hundred decibels. The fact that great distances can be spanned also in the VHF wave range is of great practical significance for the following two reasons: (1) it is possible to disturb local reception by means of very distant transmitters and (2) with sufficient radiating power, the number of relay stations can be reduced. Thus, research on these extra-long distances has become prominent internationally. As yet, a clarification of the above-mentioned phenomena by means of ducte or reflections on the atmospheric layers thus far observed is impossible because of the frequency of the occurrence of the phenomena. It can be stated with some certainty only that the causes for these phenomena can be sought in the small discontinuities of the index-of-refraction gradient. Such discontinuities can be the reason for scattering processes (Streuprozessen). The works of Booker, Gordon, Weisskopf and Villars which treat this subject are generally used for calculations at present. However, meteorologically there is still little known about the detailed structure of the atmosphere, so the theories developed are still based on a series of assumptions and idealizations. The Heinrich Hertz Institute has investigated to what extent partial reflections, instead of scattering processes in the small discontinuities (which are certainly present), can produce the observed field intensities. Results thus far obtained, based on assumptions concerning the status of the atmosphere similar to the assumptions used by scattering theories, reveal that theoretical results obtained on the basis of partial reflections correctly describe wave propagation both in respect to quality and magnitude. More exact calculations will only be possible when the origin and properties of the small discontinuities are clarified. From the results of research at the Heinrich Hertz Institute, it can only be concluded that both calculating methods (partial reflections and scattering processes) lead to the same result.

2. Field intensity measurements were made simultaneously on observation lines of 200 kilometers, 360 kilometers and 450 kilometers, and the measured values were compared with the calculated values. The calculated and measured values were in close agreement. The daily changes observed were caused by the inversions occurring during the forenoon and the evening hours (a condition for propagation); the field intensity increases were superimposed on the normal extra-long distance propagation. Data on the size and speed of the layers over the line were obtained by experimental observation of tunnel propagation.

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